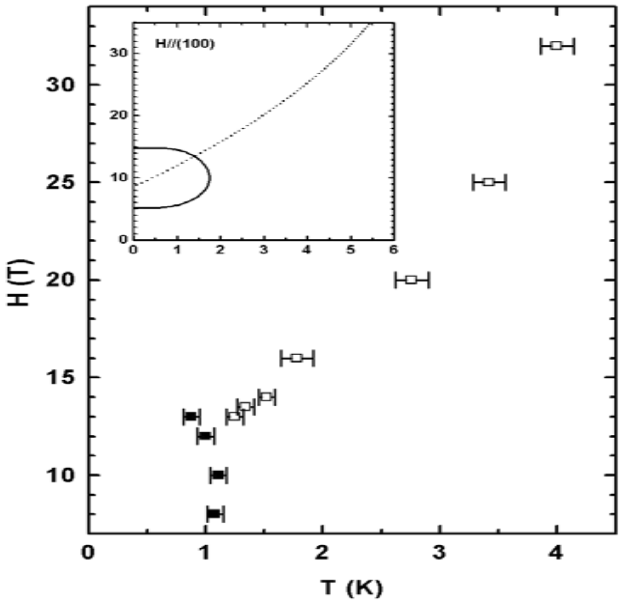
Synthesis and Characterization of Unconventional Heavy Fermion Materials, Bohdan Andraka, University of Florida, DMR-0104240

Heavy fermion systems based on Pr form a new frontier of strongly correlated electron systems. The first clear-cut example of a heavy fermion state in this category is provided by a scutterudite material, $PrOs_4Sb_{12}$. Scutterudites have also been lately recognized among most promising thermoelectric materials. We have investigated high quality single crystals of $PrOs_4Sb_{12}$ grown in-house and obtained via a collaboration with Japan in magnetic fields to 32 T. We have discovered a new line of anomalies and postulated a model of the crystalline electric field of Pr. Our results preclude established models of heavy fermion behavior and call for a new theory.



Measured magnetic phase diagram of $PrOs_4Sb_{12}$ with model calculations (inset).

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Education:

Costel Rotundu, currently the third year graduate student has been fully supported by the award. During this last year, he furthered his knowledge of sample synthesis, characterization, and measurement techniques. In addition to measurements performed at the University of Florida, he has participated in experiments at the National High Magnetic Field Laboratory in Tallahassee. He has spent six weeks at Tallahassee taking part in heat capacity measurements using both resistive 33 T magnets as well as superconductive magnets and dilution refrigerator.

Outreach:

The P.I. has participated in the University of Florida Student Science Training Program, designed for the gifted/high achieving 11th grade and qualified 10th grade students. The P.I. was a mentor of a 10th grade student, Richard Brandon Horn. Richard spent seven weeks, 35 hours a week, in the P.I.'s laboratory directly under his supervision. Richard has participated in a wide range of research activities, including sample synthesis and characterization, specific heat and magnetization measurements and engineering aspects of data acquisition and analysis.